IE 362 Lecture 0: Course Orientation

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Course Objectives

- This course is designed to teach
  - Software design and development techniques for students at ISE
    - How to model and solve ISE problems with software
    - How to efficiently design and implement the software
      - Efficient design → Learning efficient data structures and algorithms
      - Efficient implementation → Learning programming languages and skills
- In short, this course is a mixture of
  - Data structure and algorithms in computer science
  - Software design and Programming languages
    - Python
  - ISE applications (example level)
- After the course, students are expected to have a basic capability to solve ISE problems with software

Topics

- Programming languages
  - Python Overview
- Object-oriented paradigm and software design
  - Class concept such as inheritance, polymorphism,…
  - Simple UML diagrams
- Data Structures
  - Linked list, stack and queue
  - Binary Search Tree
  - Priority Queue and Heap
  - Hashing
  - Graph
- Algorithms
  - Algorithm analysis
  - Recursion and dynamic programming
  - Sorting
  - Dijikstra's algorithm
- Applications
  - Application 1: Simulation
  - Application 2: Genetic Algorithm
  - Application 3: Network analysis

Intuitive Analogy – Finding Restroom in Building

- You enter a building to use a restroom
  - This is your fist time in the building.
  - How to find the restroom?

Walk around?

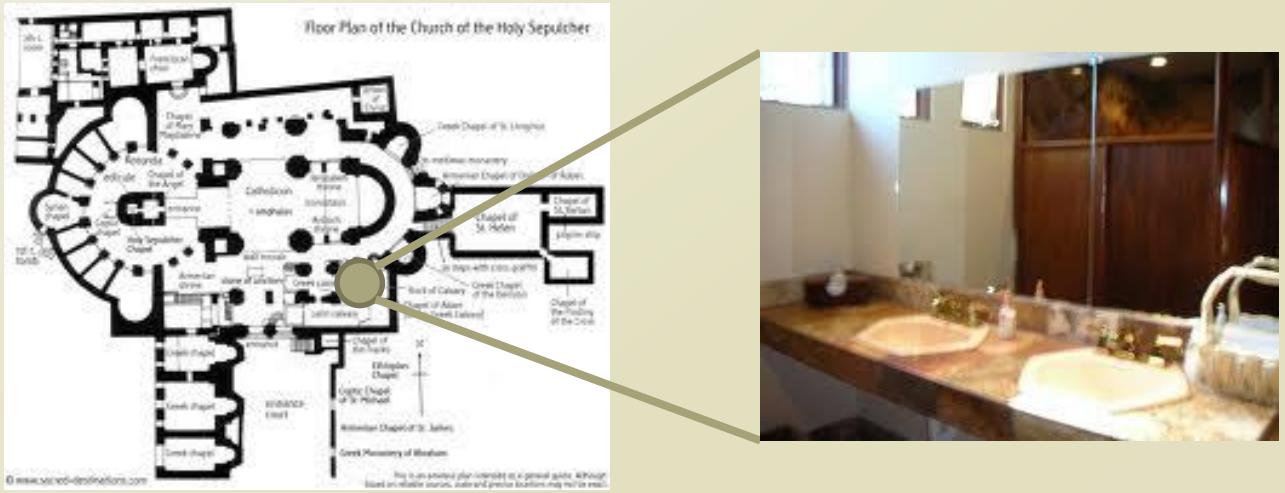
Sign?

Guess?

Ask?

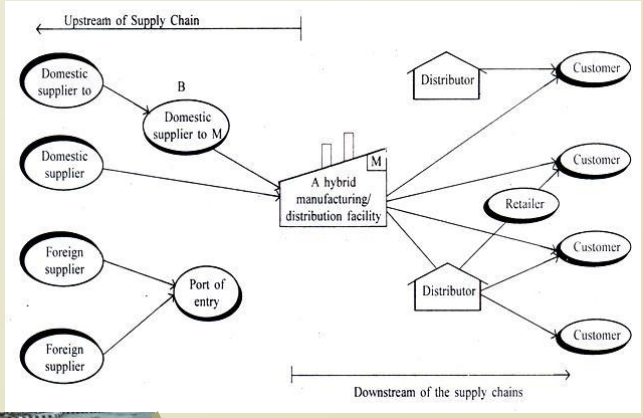
Data Structure and Algorithm

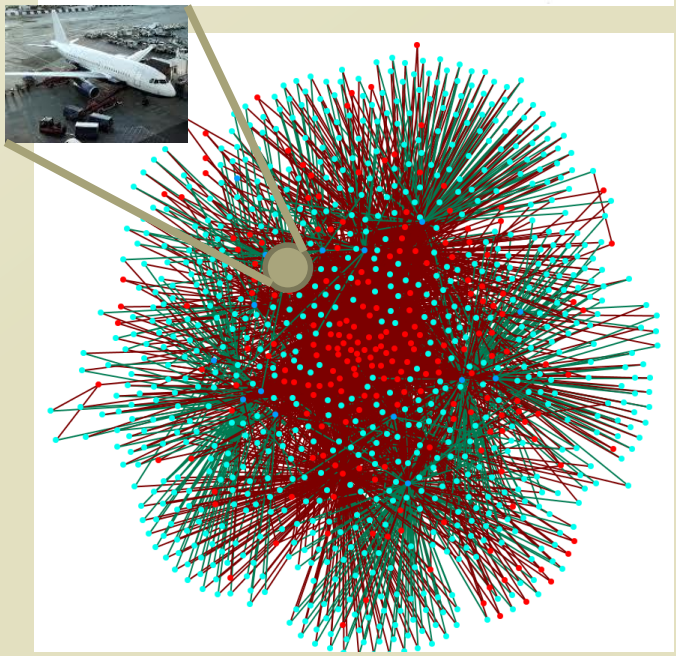
- Data structure → Where to put the restroom
  - A structural method to organize data in software
  - Fundamentally, how to organize data in your problem
- Algorithm → How to find the restroom
  - In general, a step-by-step procedure for calculations
  - In this course, a procedure for utilizing the data structure



Sample ISE Problem

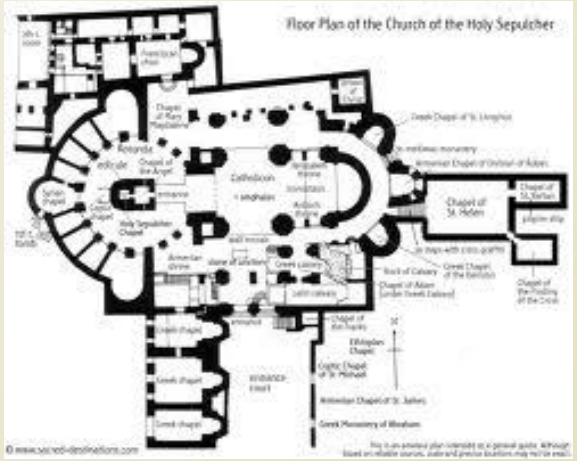
- Typical supply chain management problem
  - Traditionally, seen as a queuing problem
  - Now more complex,
    - Chain
      → Network
  - Now more large scale
    - Local supply chain
      → Global supply network
  - Now more impact than before
    - Low logistics cost
      → High logistics cost
- Need software to model the problem and to solve it

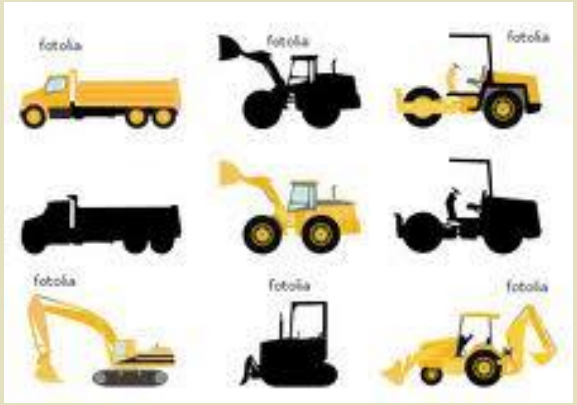




Programming and DS&A

- What is programming to data structure and algorithm?
  - Programming is an implementation tool
  - Conceptual thinking and design
    - Where to put the restroom
    - How to find the restroom
  - Practical design and implementation
    - What to use for designing the restroom
    - How to move to the restroom
- Both are important
  - Should pursue good design and good implementation
  - Good design and bad implementation?
  - Bad design and good implementation?





Textbooks

- None
  - This course does not require students to purchase any textbook. Most of the topics will be discussed by utilizing course materials. However, students will find further assistance from the reference books listed in the below.
- Reference books
  - Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

What we need

- You need to watch the video before you come in
  - There will be very short recap on the video
- Two person team
  - Programming, discussion and joint work
  - For offline course only
  - Homeworks and quiz are designed for an individual
- Offline course gear: Laptop with Python
  - Install Python 3.5 and the most recent version of PyCharm
    - PyCharm provides the academic license
  - **Finish coding "HelloWorld" in the slide with your setup**
- We are very likely to meet once a week
  - Monday
  - Special occasions, Monday and Friday
    - Friday????
    - Students who need extra hours
    - (someone who failed to get certified by TA in offline lectures)

Grading

- Class participation and quiz: 25%
- Exams: 50%
- Homework: 25%
  - Copy will result in the letter grade of F
  - We will use a detection system.
  - No argument will be accepted if the pattern is obvious.
- Subject to change by the students' performance and participation

- Usually curve grading, but this time, I am not sure
  - I will be fair.
  - The ratio of A:B:CDF is 4:4:2.
  - Will see similar number of As and Bs
  - After the 2/3 of the semester, you will get warnings when you are about to receive below D.
  - If you have concerns about your grades for a specific circumstance, state your situation prior to the third weeks of the semester.
    - No cutting slack.
    - But, the TA will monitor your grades and tell you what to do more.

Exam and Homework

- Solving problems in the industrial and systems engineering domain by utilizing **Python** and data structure/algorithm knowledge
- Submission guideline:
  - TBD
- Penalty:
  - Delay: 10%/day (deducting from its original score of the submission), Maximum 50% penalty, so you do not need to submit homework after five days delay.
  - No submission: One letter grade down per one no-submission
  - Violation of academic integrities: Two letter grades down per one violation, The second violation will give the student the failure grade (when the violation occurred in exams, the student will receive the failure grade regardless of the count of the violations)

Week	Subject	Methods	Contents Plan	Homework	Etc.
1	Python Overview	Online Lecture			Compose Team Phase 1
		Offline Exercise	Naive Bayes classifier Conditional probability calculation		
2	Object-oriented paradigm and software design	Online Lecture			Offline Recitation 1
		Offline Exercise	Naive Bayes classifier Classifier with prior and likelihood	Linear regression structured Newton method based regression analysis	
3	Linked list, stack and queue	Online Lecture			
		Offline Exercise	Production line model Stack and queue implementation		
4	Recursion and dynamic programming	Online Lecture			Offline Recitation 2
		Offline Exercise	Production line model Scheduling with dynamic programming	Blackjack game Dynamic programming based Blackjack gamer	
5	Application 1: Simulation	Online Lecture			
		Offline Exercise	Production line model Probabilistic interrupt modeling		
6	Binary Search Tree	Online Lecture			Compose Team Phase 2 Offline Recitation 3
		Offline Exercise	Decision Tree Decision tree node implementation	Calculator Binary tree based calculator	
7	Algorithm analysis	Online Lecture			
		Offline Exercise	Decision Tree Decision tree implementation		
9	Priority Queue and Heap	Online Lecture			
		Offline Exercise	Decision Tree Random forest implementation		
10	Application 2: Genetic Algorithm	Online Lecture			Offline Recitation 4
		Offline Exercise	Traveling salesman problem Completing the testbed of TSP	TSP Competition TSP with Genetic Algorithm	
11	Sorting	Online Lecture			Compose Team Phase 3
		Offline Exercise	Text analysis List based TF-IDF calculation and sorting		
12	Hashing	Online Lecture			Offline Recitation 5
		Offline Exercise	Text analysis Hash based TF-IDF calculation and sorting	Keyword analysis Text classifier with keyword selection and naïve Bayes	
13	Graph and Dijikstra's algorithm	Online Lecture			
		Offline Exercise	Social network analysis Local metric calculation on Seoul Metro Stations		
14	Graph and Dijikstra's algorithm	Online Lecture			Offline Recitation 6
		Offline Exercise	Social network analysis Global metric calculation on Seoul Metro Stations	Supply hub location Multiple logistic hub selection on Seoul Metro Stations	
15	Application 3: Network analysis	Online Lecture			
		Offline Exercise	Social network analysis PageRank calculation on Seoul Metro Stations		

TA System

- You will have about 3~4 rotations on the team pair.
  - You will meet a new friend once per month.
  - Coordinated by the random generator
- Also, for each rotation, you will have assigned offline TA.
  - TA will take care of 6~7 teams (12~14 students)
  - TA helps you finish the offline tasks
- For each homework, you will have two assigned HW TA.
  - TA will only guide you through the HW
  - They do not give you straight answer.
  - Definitely, they will not touch your codes
- If you have any grievances,
  - Talk to your designated TA
  - If that doesn't work, talk to the head TA
  - If that doesn't work, talk to me

Contacts

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- Teaching Assistant
  - Mr. Kyungwoo Song (Head TA)
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  - Office location: E2 #4102

A Few Remarks

- Please don't cheat
  - Never use 족보!
  - No cheating neither in offline nor homework
  - This semester, we will use code similarity checking tools
- Please don't disturb others
  - You can remain in the offline classroom after you finish tasks
    - Do homework, study, etc
  - Don't tell others how to solve the problems
    - That is TA's job
- Your skill will be developed as much as you code
  - Seek coding materials
  - Review how the provided code works